all elements having specific gravities sufficiently greater than the mean at a given level descend through the horizontal plane at that level, and therefore displace lighter water upward through the plane at the same rate. Thus the magnitude of this upward flow of relatively warm and light water is greatest at the surface and decreases continually from the surface downward.

4. The velocity of descent of each element is proportional to the difference between its specific gravity and the average specific gravity of the water at that level.

5. The observed value of any property of the water, physical or chemical (temperature, salinity, CO, etc.), at any depth is the average of the values for all of the water particles or elements, both ascending and descending at that level.

From the assumptions stated above two fundamental equations, one a partial differential equation and the other an intrgral equation, have been deduced. The first involves the temperature of the rising elements and the second that of the rising elements, the descending elements, and the average, or observed temperature. In addition, the times, depths, and certain constants are involved. Although solution of the equations has not proved practicable, the variables entering in can be computed from temperature observations and the relation of specific gravity to temperature. Thus a series of equations, two for each depth, is formed in which the constants stand respectively for the rate of absorption of solar radiation by water, the rate of evaporation, and the rate at which solar radiation penetrates the water surface. The only observations required are the temperatures at a series of depths and their time rates of change at each depth.

Emphasis has commonly been placed upon meteorological observations rather than observations on the water itself in connection with evaporation researches. The importance of meteorological factors in evaporation is undisputed. Hence, determinations of the rate of evaporation, solely from water temperature observations without using meterological data, explicitly must imply that the external factors influence the water temperatures, and thus indirectly determine the computed value of the evaporation.

Preliminary computations have yielded values of the solar radiation, the absorption coefficient of radiation, and the rate of evaporation, all in good agreement with observation. Judging from the experience already gained, any thorough investigation of evaporation from water surfaces should involve observations of the water temperatures at different depths and times. Moreover, a sufficiently refined theoretical development along the line indicated in the present paper may contribute to the important question: What is the actual rate of evaporation of water from a lake or reservoir? (Excerpts from author's abstract.)

A detailed explanation of the above theory, together with typical numerical applications and tables for facilitating the computations, is being prepared for publication.

WIND DRIFT IN RELATION TO GIPSY MOTH CONTROL WORK

During May and June, 1923, an interesting series of observations with small balloons was carried on by the Conservation Commission of the State of New York, Alexander Macdonald, commissioner,[1] in connection with investigations on the spread of the gipsy moth. Previous investigations had shown that wind is a very important factor in the spread of this pest. "Recently hatched caterpillars, less than a quarter of an inch long, are carried by winds when the temperature is 60° F. or higher, and under certain conditions may drift long distances, 20 or possibly 25 miles." Studies were therefore made with a view to determining the probable spread in a given period, the ultimate aim being to secure data on which to base the selection of the most practicable region for a "control zone," in which the destruction of all infestations could be accomplished with least expense and at the same time most effectively. The experiments were conducted under the immediate direction of Dr. E. P. Felt, chief entomologist.

In 1922 the most seriously infested area was that of western Massachusetts, southwestern Vermont, and northwestern Connecticut. Studies of wind frequency were therefore made at selected stations in this region and these showed during the period May 10 to June 8, 1923, that easterly winds occurred at the surface 9 per cent of the time, westerly winds 50 per cent, northerly 47, and southerly 17. The danger of spread into New York State is thus seen to be rather small, so far as surface winds are concerned. Data from the Weather Bureau stations at Albany, Burlington, and Northfield bear out this assumption.

These studies were supplemented by the use of some 7,000 hydrogen-filled toy balloons. The balloons were inflated for a minimum buoyancy, only low altitude drift being desired. Each balloon carried an addressed tag requesting the finder to fill in certain data and then forward the tag by mail. Of the nearly 7,000 balloons released reports were received from 422, about 6 per cent, and 298 of these contained detailed information. A large proportion came down in southern New England, some reaching the eastern and southern coasts and a few crossing the Sound and landing in Long Island. Thus, the general drift was southeastward. About 25 per cent maintained a practically constant direction throughout the flight; a few reached moderate heights and reversed their direction—one actually fell within 15 feet of its starting point, after being in the air more than 6 hours. *Somewhat less than 2 per cent of the total drift was in a westward direction.*

So far as the primary purpose of this investigation is concerned, the conclusion is that the spread of insects westward by wind is likely to be small and that therefore an effective control zone can be established and maintained at comparatively small cost. Meteorologically, the results are of interest as confirming in a general way our ideas of wind frequency in the lower levels, except that the percentage of easterly winds as determined from more extensive data is considerably greater than here shown. The shortness of the period of observation makes inadvisable anything like an unreserved acceptance of the results as generally representative, and, of course, to this extent the conclusion as to the effectiveness of a control zone should be likewise modified.—W. R. G.

[1] Thirteenth Annual Report, Legislative Document (1924), No. 30, pp. 158–169.

NEW ARRANGEMENT OF METEOROLOGICAL WORK IN PORTUGAL

Under date of February 25, 1924, the Director of the Marine Meteorological Service of Portugal, writing from Lisbon, informs this office of a decree of the Portuguese Government which effects a new distribution of the